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ON THE KINETICS OF THE LIBERATION OF THE ANTIBIOTICS CONTENT OF THE VARIOUS TYPES OF BACTERIOCINOGENIC MICROBES

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ON THE KINETICS OF THE LIBERATION OF THE ANTIBIOTICS CONTENT OF THE VARIOUS TYPES OF BACTERIOCINOGENIC MICROBES

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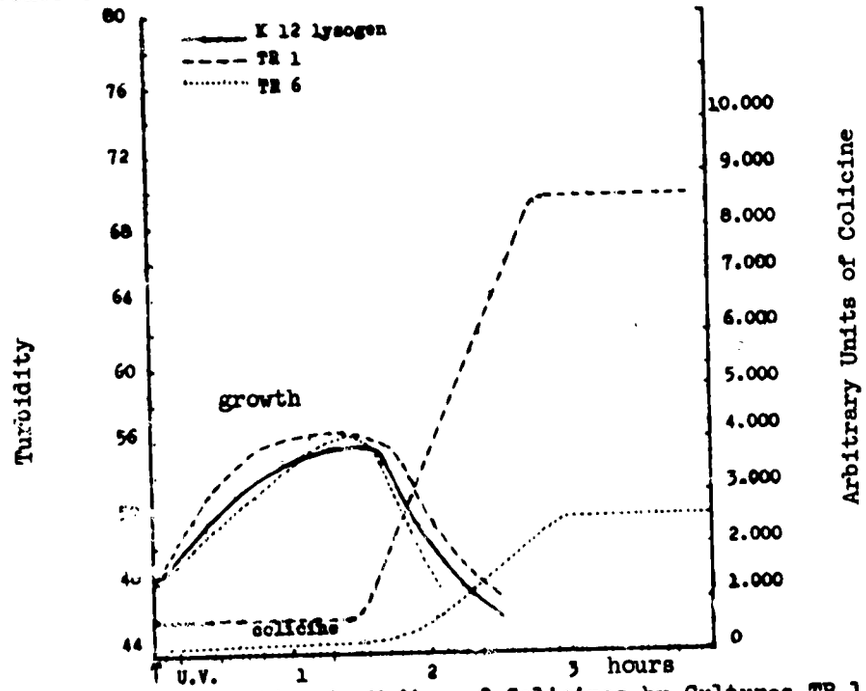
a precise analysis of the previous experimental results.

1) The transfer of the colicinogenic property of a strain belonging to a to K 12 S gives a new antibiotic culture belonging to this category; on the other hand the transfer of the antibiotic property to culture K 12 (γ) sometimes gives a culture belonging to category b. 2) The transfer of the colicinogenic power only of a strain belonging to category b to K 12 S gives a new antibiotic culture which never belongs to this category; the transfer of this colicinogenic power to K 12 (γ) always gives a culture belonging to category b. From these observations it follows that neither the specificity of the antibiotic power (constitution of the colicine) nor the nature of the receptor bacterium are responsible for the deferred liberation of the bacteriocine and that on the contrary, the lysogenic property ought certainly to play a part in this phenomenon. 3) The lysogenization by phage of cultures TR 1' (K 12 S (colicine E 1)) and TR 24 (K 12 S (colicine B)) which belong to category a leads to cultures TR 1 and TR 6 which belong to category b (see figure). Likewise, the lyogenization of pyocinogenic culture St 6 of P. pyocyanea, which belongs to category a, by the phage of lysogeneity of Stern's strain, leads to a culture belonging to category b (one hour after irradiation an abrupt 20- to 30-fold rise is produced in the pyocine titer). Hence it is the development of prophage in the ensemble of these microbial populations that provokes the accumulation of bacteriocines on the bacterial level.



Kinetics of Liberation in Medium of Colicines by Cultures TR 1 and TR 6

The inhibition of the passage of the bacteriocines in the medium is produced already at the time of irradiation since it continues during the entire period of the proliferation of the phage: The start of the inhibition is thus brought about by a very early process of lysogenic induction, that is, when the prophage is located on its chromosomic site. It is only through the lysis of the culture that the bacteriocine is liberated in the medium, together with a considerable quantity of bacteriophages. Nevertheless among the 12 cultures of P. pyocyanea which we have studied, four belonged to category b, but they only produced an amount of bacteriophage that is much too low to account for the accumulation of the pyocines. Hence it would be necessary to assume the existence, in the majority of these bacteria, of a bacteriophagic development sufficient to provoke the inhibition of passage of the pyocines in the medium but insufficient to continue until the complete maturation of the corpuscles. Hence, adopting Jacob's (1) definition, it would seem that we are dealing with defective lysogenic bacteria, normally encountered in nature. The observations about to be described confirm this hypothesis: a) These four cultures produce an endolysine of high titer, and b) The lysogenic power of Stern's strain which, as we have just reported, induces the phenomenon of accumulation of pyocine of culture St 6, is defective.

Can virulent bacteriophages also produce this deferred liberation of bacteriocines? The infection by various virulent phages (system T, a number of phages isolated from the liquid) of antibiotic bateria TR 15, TR 21 of E. coli and KR 130 of P. pyocyanea previously irradiated with a convenient dose of ultraviolet rays, leads to the abrupt stoppage of the synthesis of bacteriocines. We have never observed so far a simultaneous synthesis of a virulent phage and a bacteriocine by the same bacterium. Since we do not know anything of the physiological phenomena which lead to the production of a bacteriocine by a bacterium, and since we are also ignorant in regard to the manner in which the passage of this antibiotic takes place in the medium, it is impossible at the present time to define the mechanism of this phenomenon of accumulation. We are only able to formulate two hypotheses in this regard:

a) If one agrees with Mujama et al (5) that the bacteriocines (or rather, their protein fraction) are synthetized in the bacterial cytoplasm, then it is possible that the phenomenon of accumulation provoked by the lysogenic induction is due to a reduction of the permeability of the cytoplasmic membrane to bacteriocines (the role of the wall in this phenomenon is excluded (2)).

b) If, on the contrary, one considers that the bacteriocines cannot pass through the cytoplasmic membrane but that they are synthetized on the exterior surface of the latter, then it is possible that the phenomenon of accumulation is due to the inhibition, in the membrane, of an enzyme responsible for the liberation of these bacteriocines in the medium.